INRAG Public Workshop
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Nuclear phase-out in Germany

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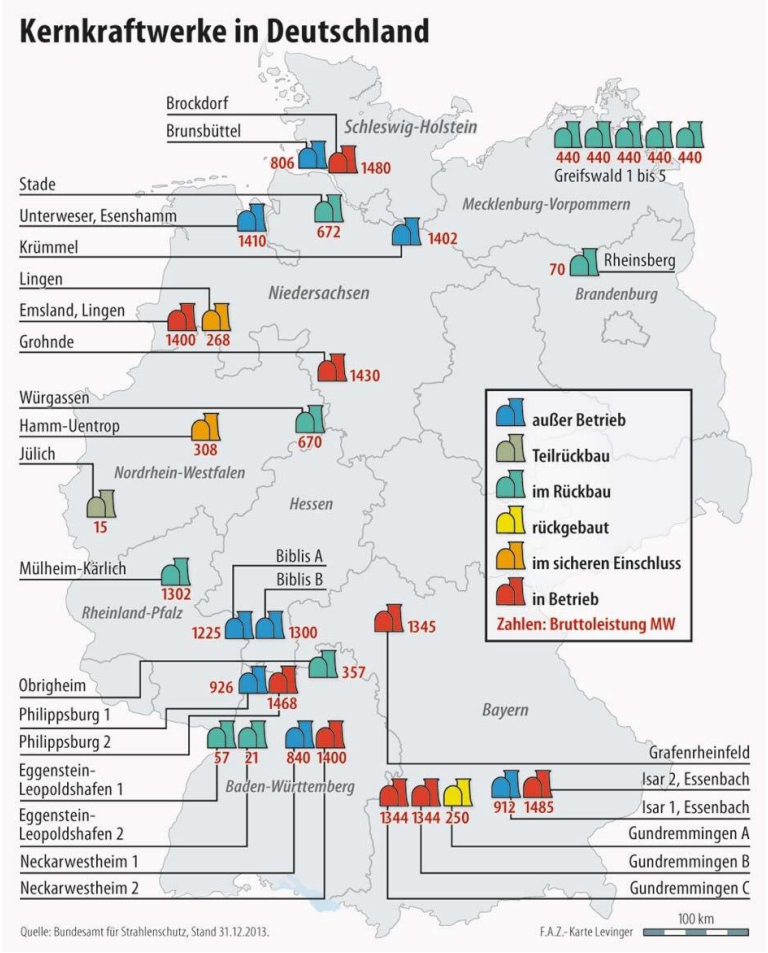
Nuclear phase-out in Germany



Most of the nuclear power plants that had been buildt in Germany have already been shut down.

Nuclear phase-out in Germany

Final shut downs of commercial NPP

- before the first phase out law (< 2002): 12 NPP
- following the first phase out law (2002): 3 NPP
- following the second phase out law (2011): 9 NPP

Still operating with last shutdown in 2022: 8 NPP

Nuclear- Phase – Out in Germany

Status of shutdowns as consequence of the second phase out law (2011):

2011:	Biblis A
	Biblis B
	Neckarwestheim 1
	Brunsbüttel
	Isar 1
	Unterweser
	Philippsburg 1
	Krümmel
2015:	Grafenrheinfeld

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Shutdown schedule of operating NPP:

- 30.06.2015 Grafenrheinfeld
- 31.12.2017: Gundremmingen B (BWR)
- 31.12.2019: Philippsburg 2
- 31.12.2021: Grohnde
  Gundremmingen C
  Brokdorf
- 31.12.2022: Isar 2
  Emsland
  Neckarwestheim 2

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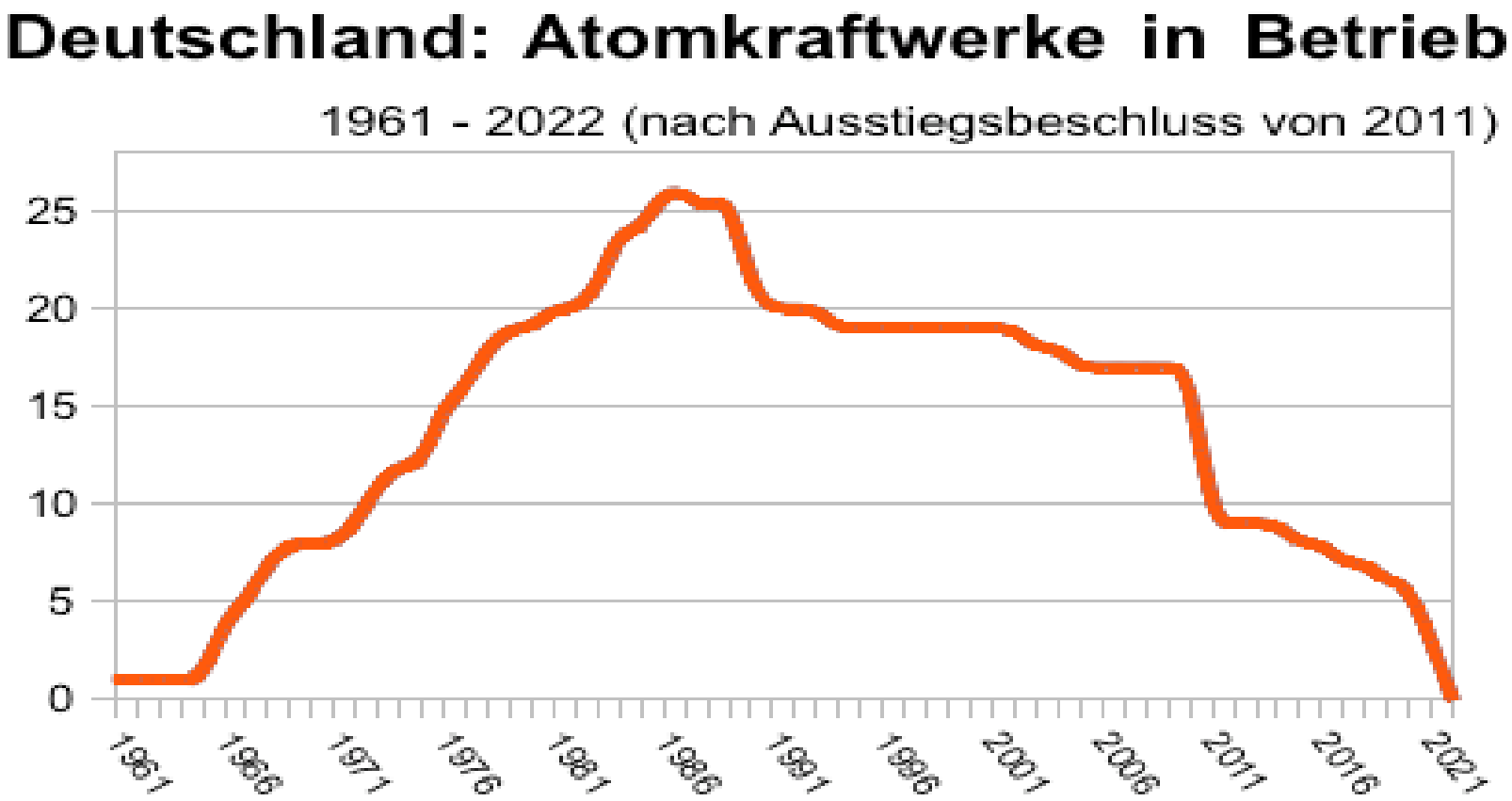

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Ministerpresident of Baden Württemberg (1973): *Planning an industriel region in the southern Rhine-Valley on the basis of six nuclear power plants*

Nuclear phase-out in Germany

Opposition 1975 against the Wyhl NPP

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Occupation of the Wyhl-NPP construction site 1975

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Consensus with the utilities (2000)

1st Phase – Out – Law 2002:

- *Limitation of the amounts of nuclear power allowed to be produced - corresponding to 32 years of lifetime.*

  => last NPP shut down around 2022
- *Amounts of nuclear power can be shifted from older plants to new plants*
- *Stop of reprocessing nuclear fuel*
- *Storage of irradiated fuel decentralized at the NPP sites*

Additionally: ***Renewable Energy Act*** *(2000)*

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Intermediate Renaissance of Nuclear Energy in Germany

2010 (Life time extension act)

+ 8 years for old plants (start of operation =< 1980): **8 NPP**

+ 14 years for younger plants (start of operation > 1980): **9 NPP**

=> last shut-down around 2036

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Angela Merkel, March 13th 2011:

„That what had been absolut unlikely has happened. This gives reason to make an new assessment of nuclear energy.“

Nuclear phase-out in Germany

Conclusion of the Ethics-Commission of the Federal German Parliament May 2011:

„Phasing out nuclear energy is necessary and is recommended by the Commission in order to eliminate the risks that result from nuclear power in Germany. It is a possible way because of existing alternatives with less risks.“

Ethik-Kommission Sichere Energieversorgung, Bericht, Berlin, 30. Mai 2011, Seite 10

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First phase out act:	2002	=>	20 NPP until 2022
Life Time extension act:	2010	=>	17 NPP until 2036
Back to the start:			
Second phase out act:	2011	=>	8 NPP in 2011
		=>	9 NPP until 12/2022

Nuclear phase-out in Germany

Assessment of the Utilities‘ lawsuits for compensation:

Vattenfall (ICSID):	4.5 Billion
RWE, EON, Vattenfall (3 Month shutdown):	0.9 Billion
RWE, EON, Vattenfall (constitutional court):	5 -10 Billion ?
RWE, EON, Vattenfall, ENBW (repayment fuel taxes):	5 Billion
==========	==========
Sum of demanded compensation (assessed) :	**~ 20 Billion**
Open: Which part of the costs for the management and the disposal of radioactive waste will not be financed by the utilities?	**10 - 50 Billion***

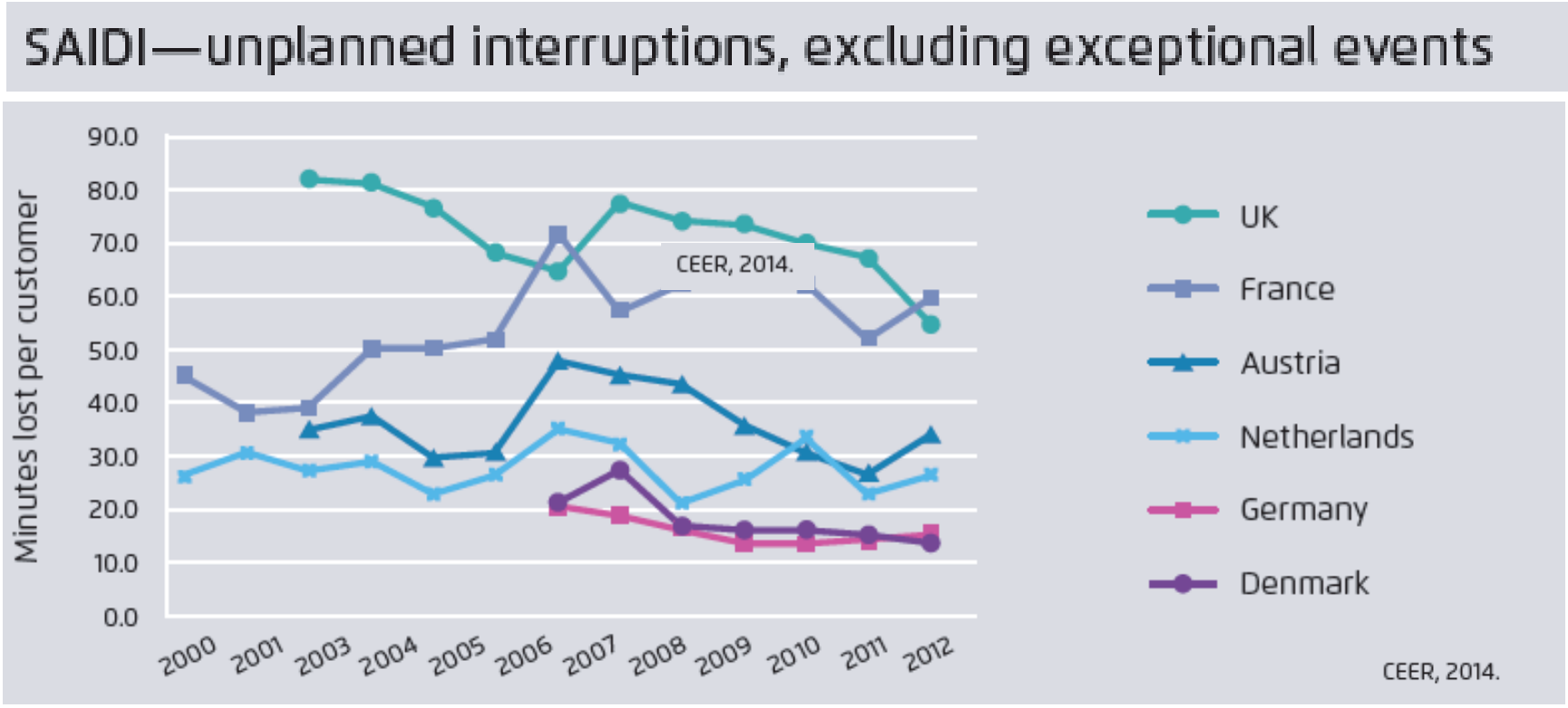
*assessed

Nuclear phase-out in Germany

Reasons why a nuclear phase out in Germany should not go

- The potential of renewables to compensate nuclear energy to weak, Renewables are economically not competitive
- Loss of power production cannot be compensated, danger of black outs:
- Germany will have to import electric power and will become more dependent
- CO2 production will rise
- The economic development will suffer; industry will leave

Nuclear phase-out in Germany



Report on the German power system, AGORA 2015, 35

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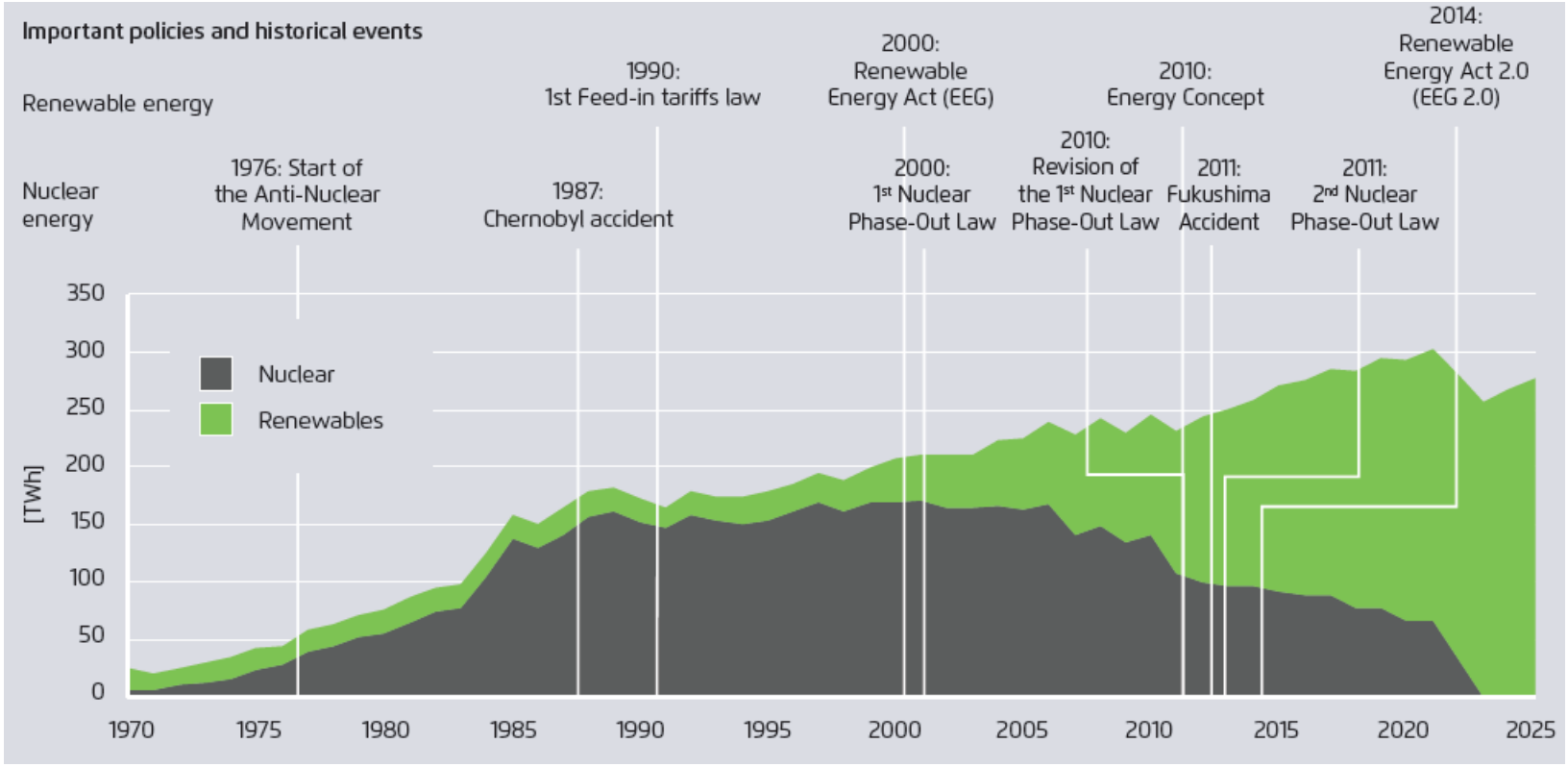
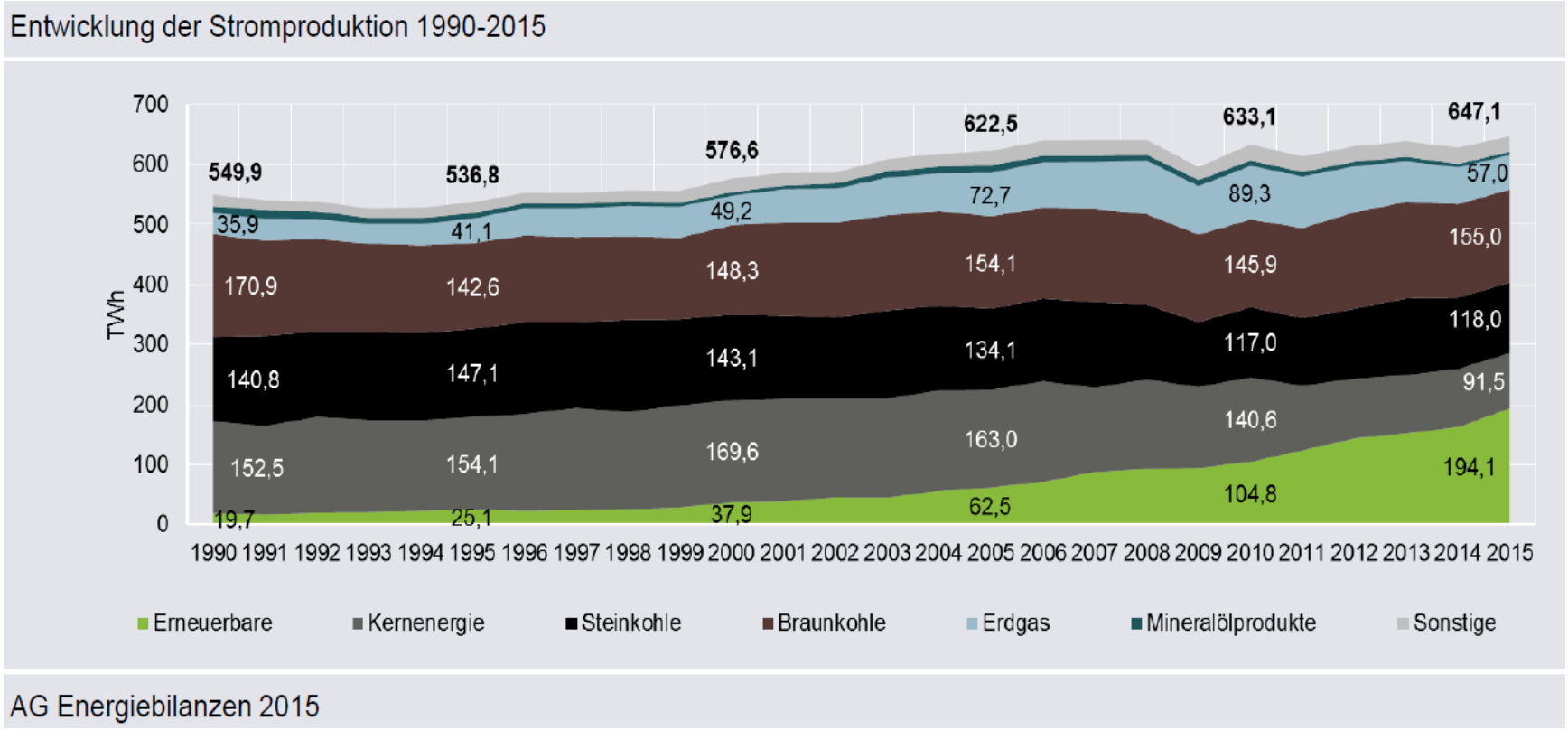


AGEB (2015), AGEE (2015), BNetzA (2014), BNetzA (2015), Statistical Yearbook of the GDR (1973 - 1988), calculations of AGORA,
Source: Understanding the Energiewende, Agora 2015, 12

Nuclear - Phase – Out in Germany

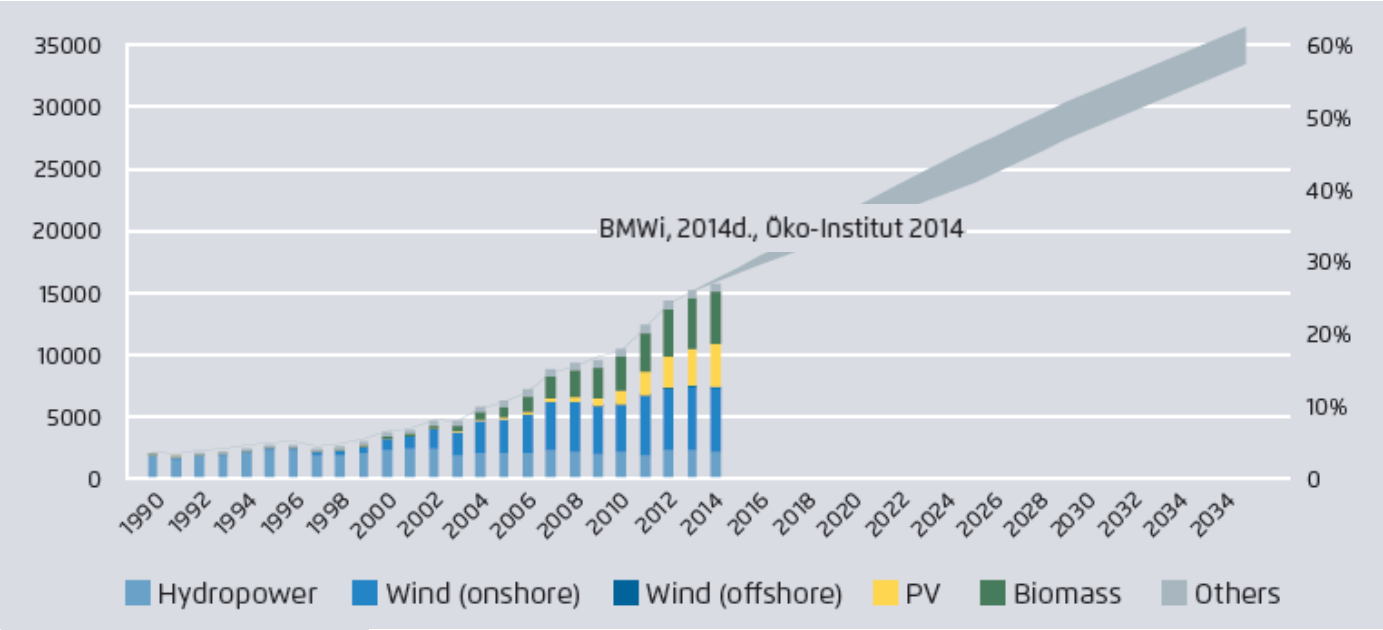
Structure of gross electricity generation in Germany, 1990 - 2014



Source: Die Energiewende im Stromsektor: Stand der Dinge 2015, AGORA 2016, 13

The German NPP - Phase - Out

Contribution of renewables to the electricity supply



BMWi, 2014d., Öko-Institut 2014

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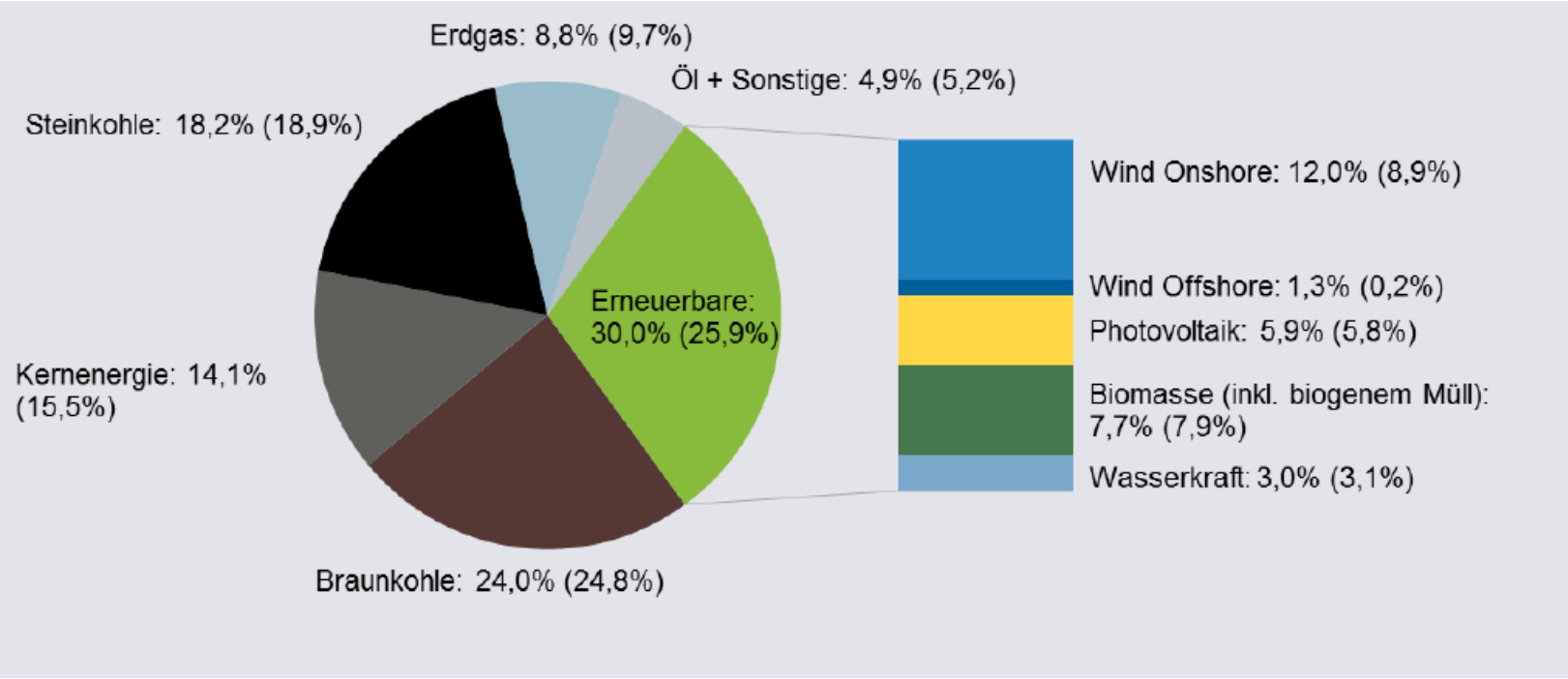
Production of electricity 2015



Source: Die Energiewende im Stromsektor: Stand der Dinge 2015, AGORA 2016, 12

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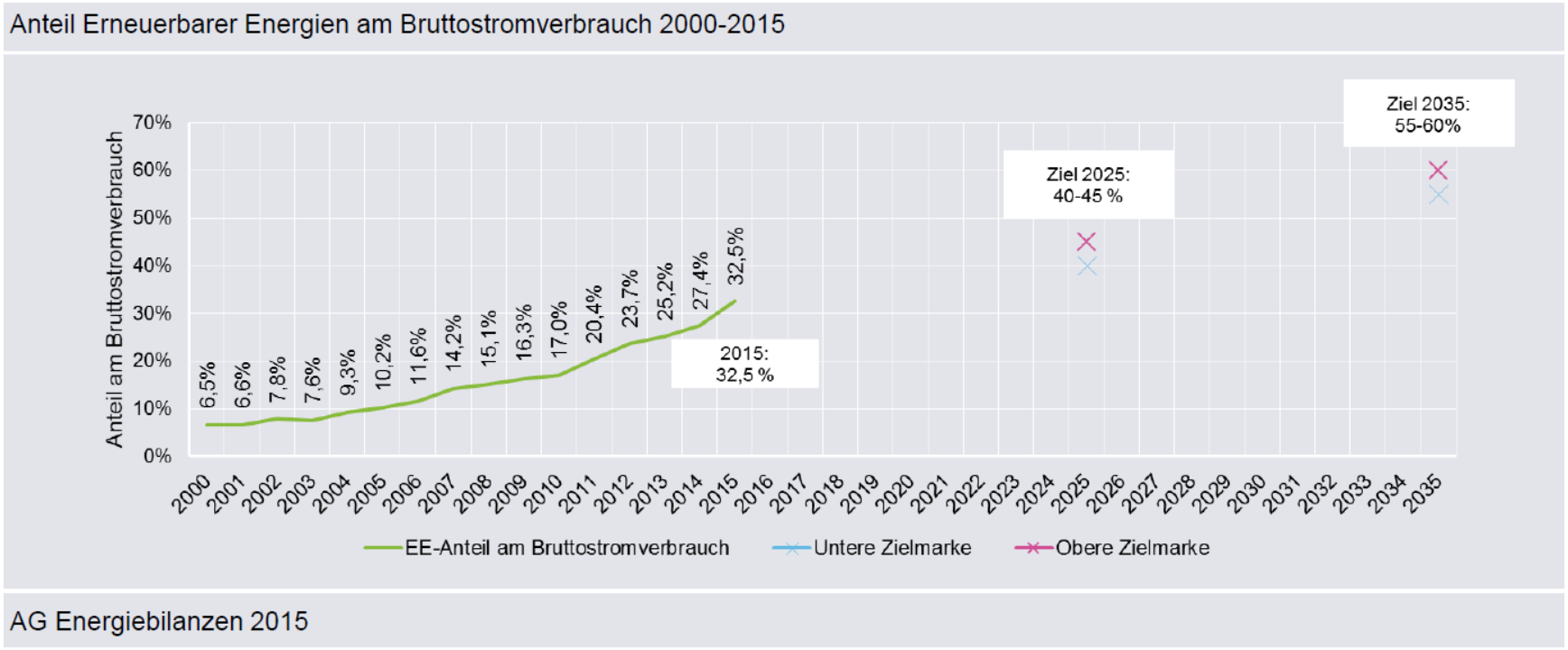
Development of renewables



Source: Die Energiewende im Stromsektor: Stand der Dinge 2015, AGORA 2016, 17

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Measures to limit the growth of the renewables

Annual capacity targets:

Maximum yearly capacity targets of

- *2500 MW of PV,*
- *2500 MW of wind offshore,*
- *800 MW of wind onshore and*
- *100 MW of biomass.*

Feed-in tariffs are adjusted automatically depending on whether the technology-specific targets are met.

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Net electricity exports from Germany to its neighbours (physical flows), 2000-2014

Source, Understanding the *Energiewende, AGORA, 23*

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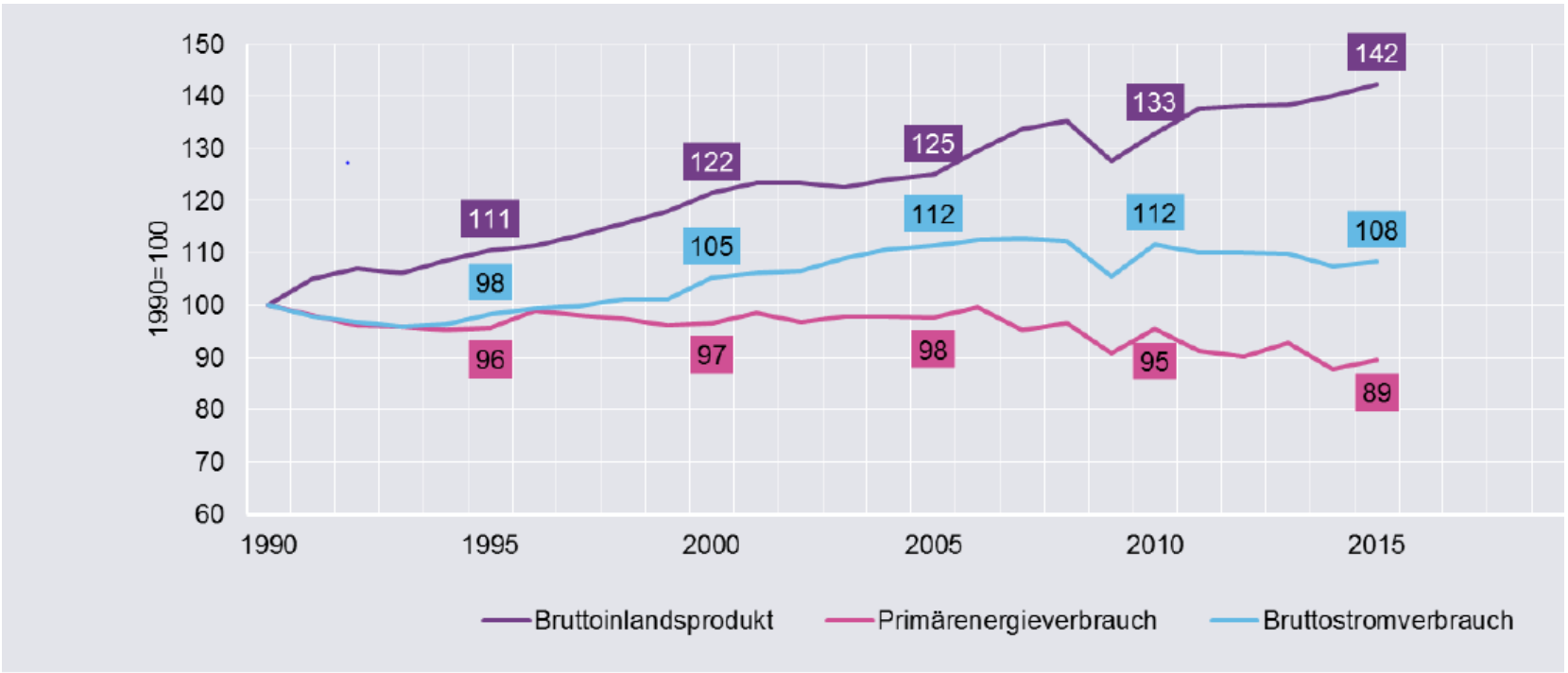
Decoupling of economic growth and Energy consumption



AG Energiebilanzen 2015; Statistisches Bundesamt, eigene Berechnungen

Source: Die Energiewende im Stromsektor: Stand der Dinge 2015, AGORA 2016, 17

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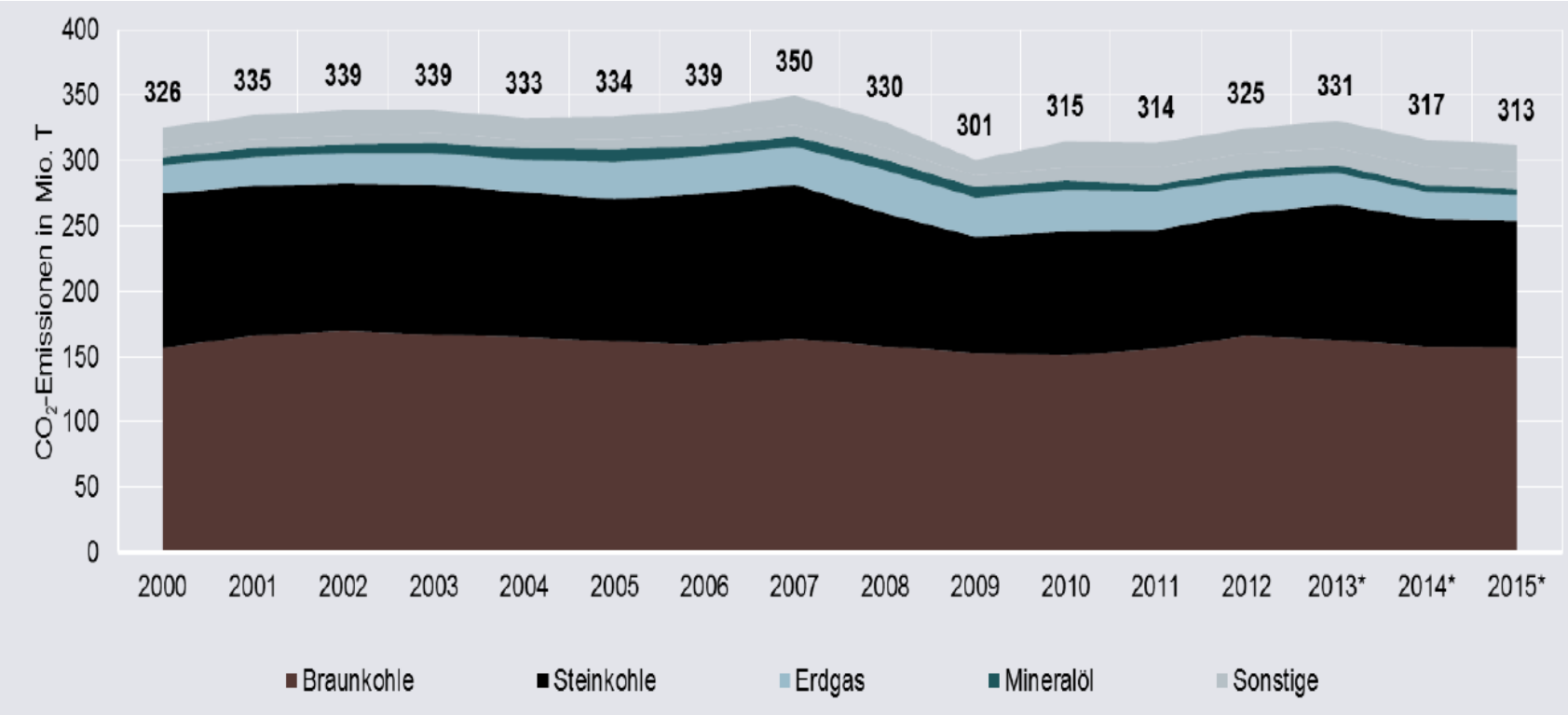
CO-2 production of the electricity sector



UBA 2015a; AGORA Berechnungen* für 2013, 2014 und 2015.

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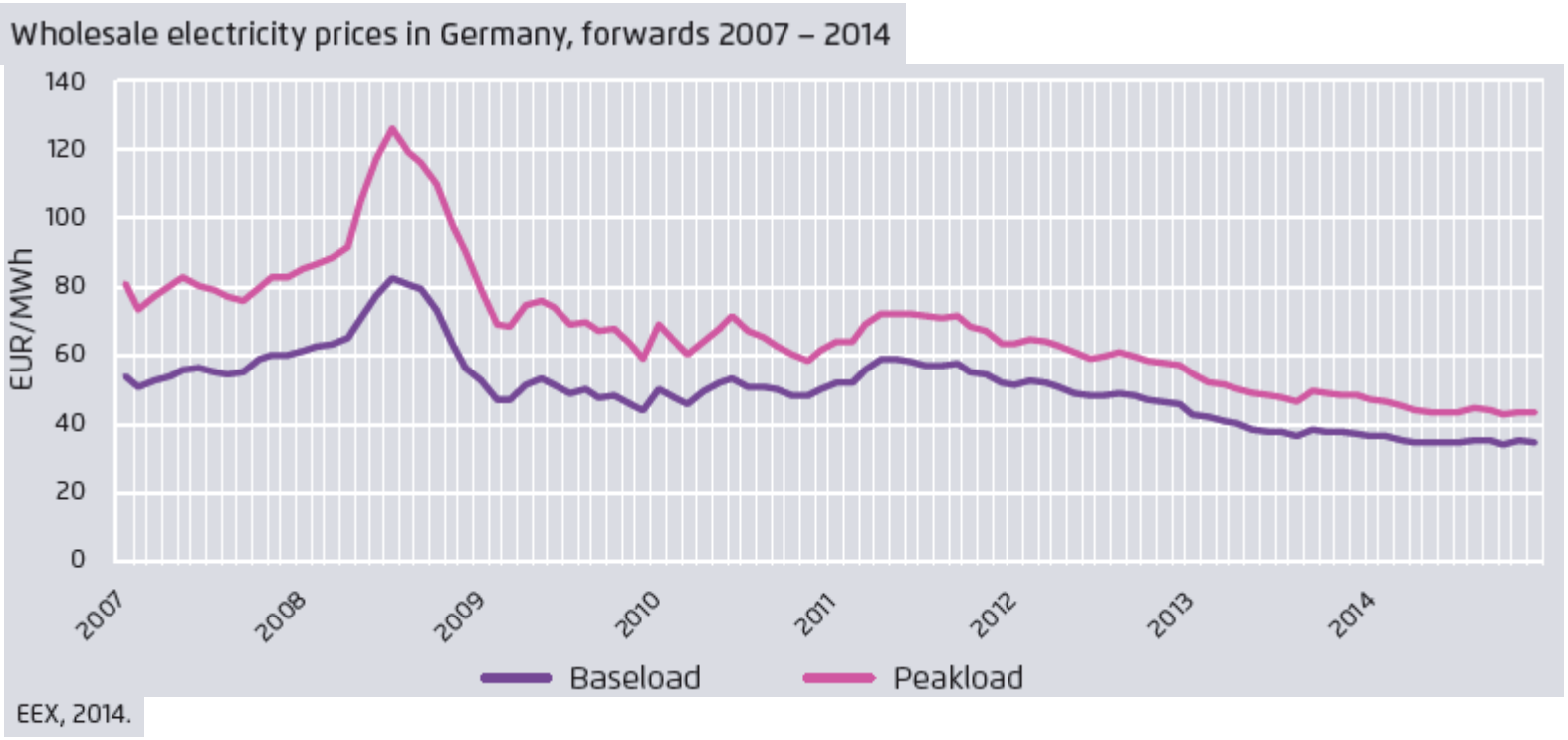

Source: Understanding the *Energiewende*, *AGORA 2015, 30*

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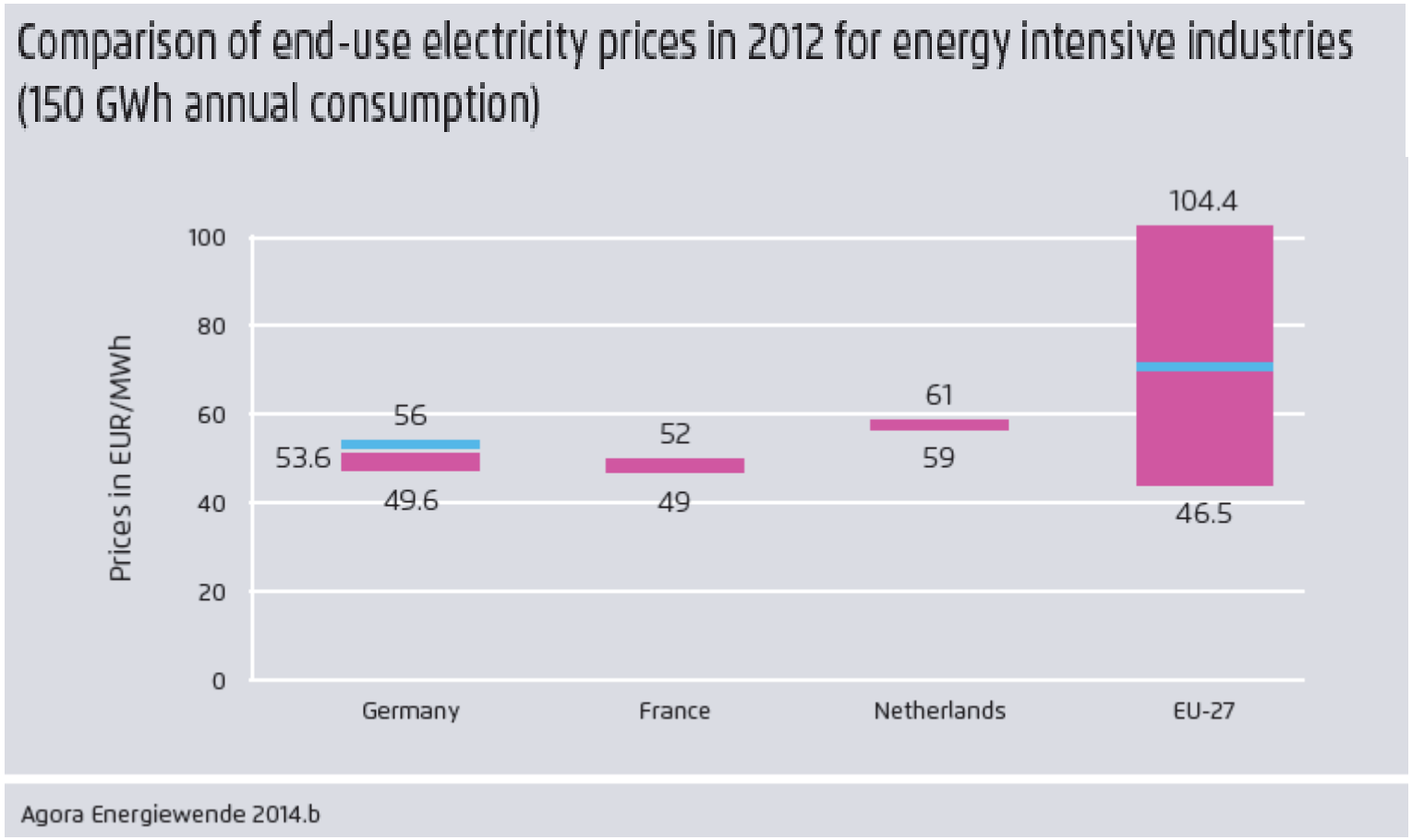

Report on the German power system, AGORA 2015, 25

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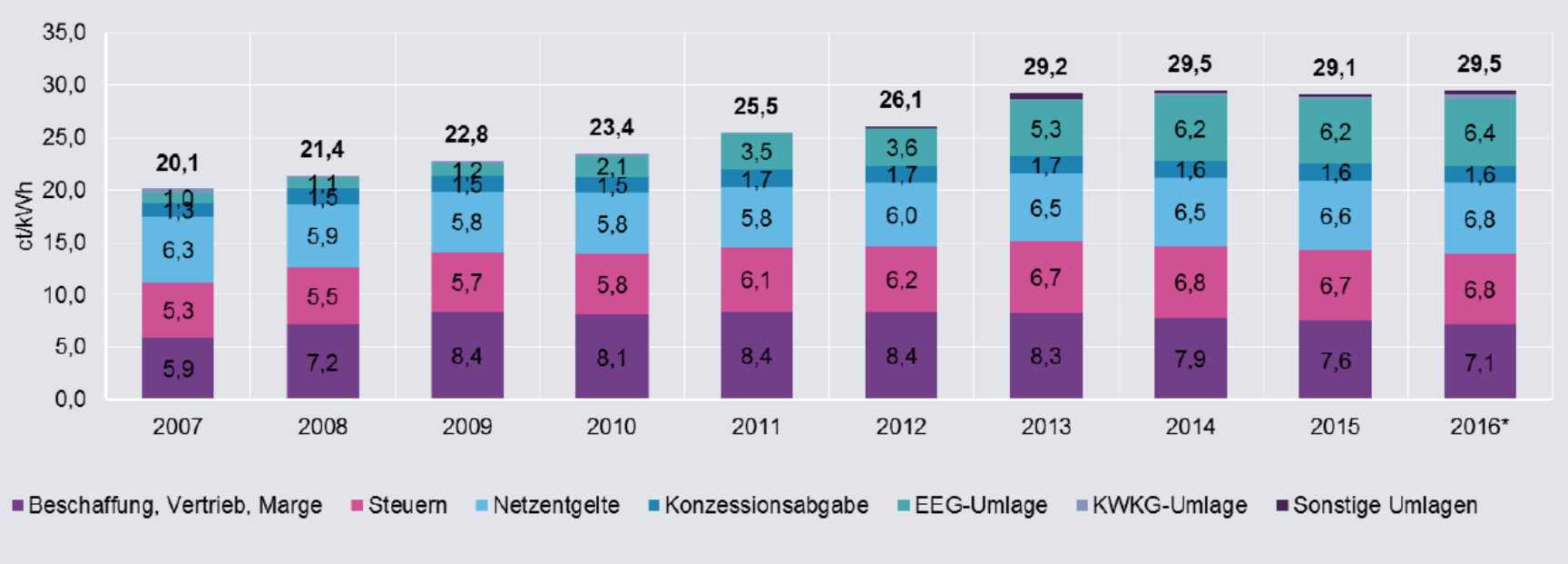
Electricity Prices of households



BNetzA2015; Werte für 2016*: AGORA Schätzung; R

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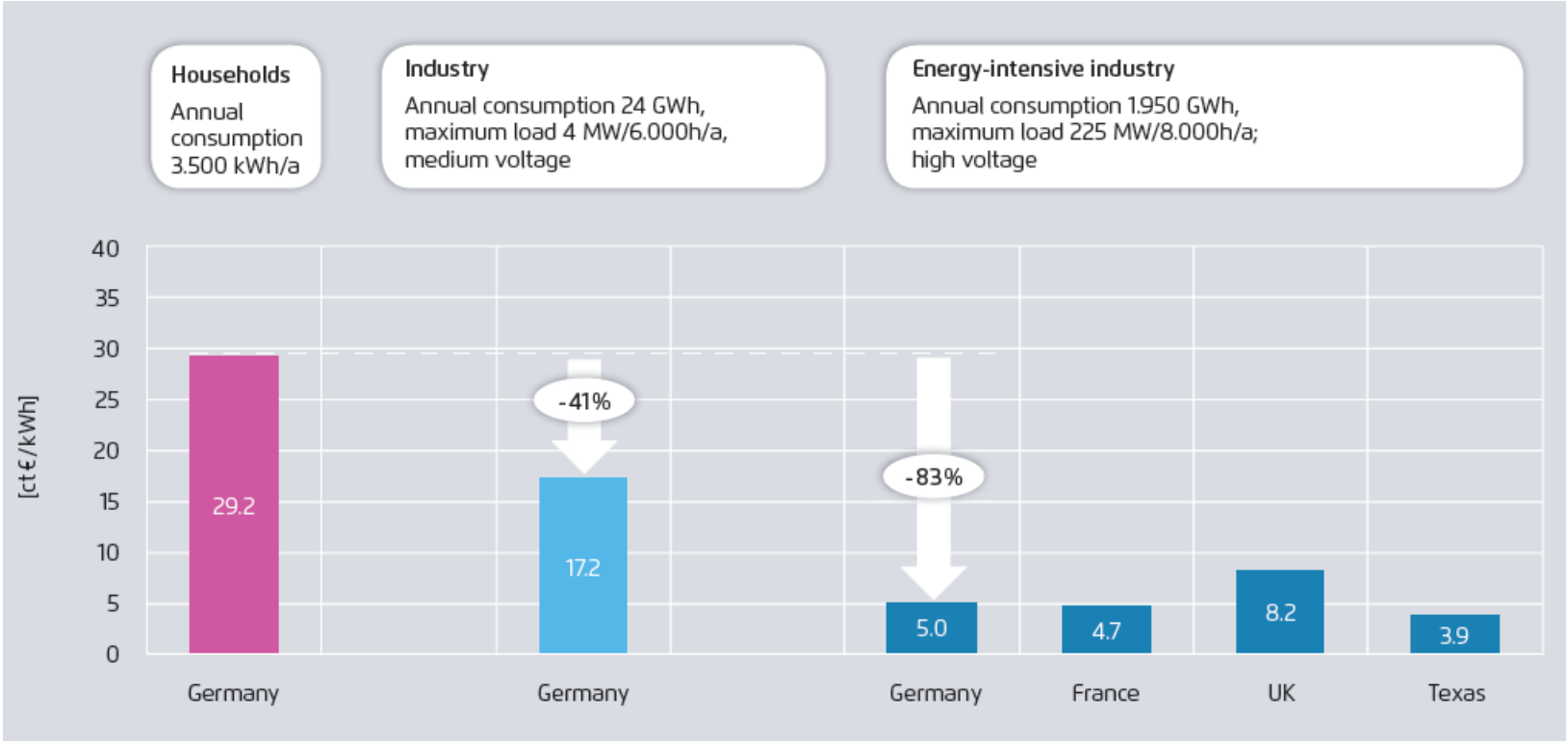
Average electricity prices for households and industrial consumers, 2013



BNetzA (2014b), Ecofys/ISI (2014)

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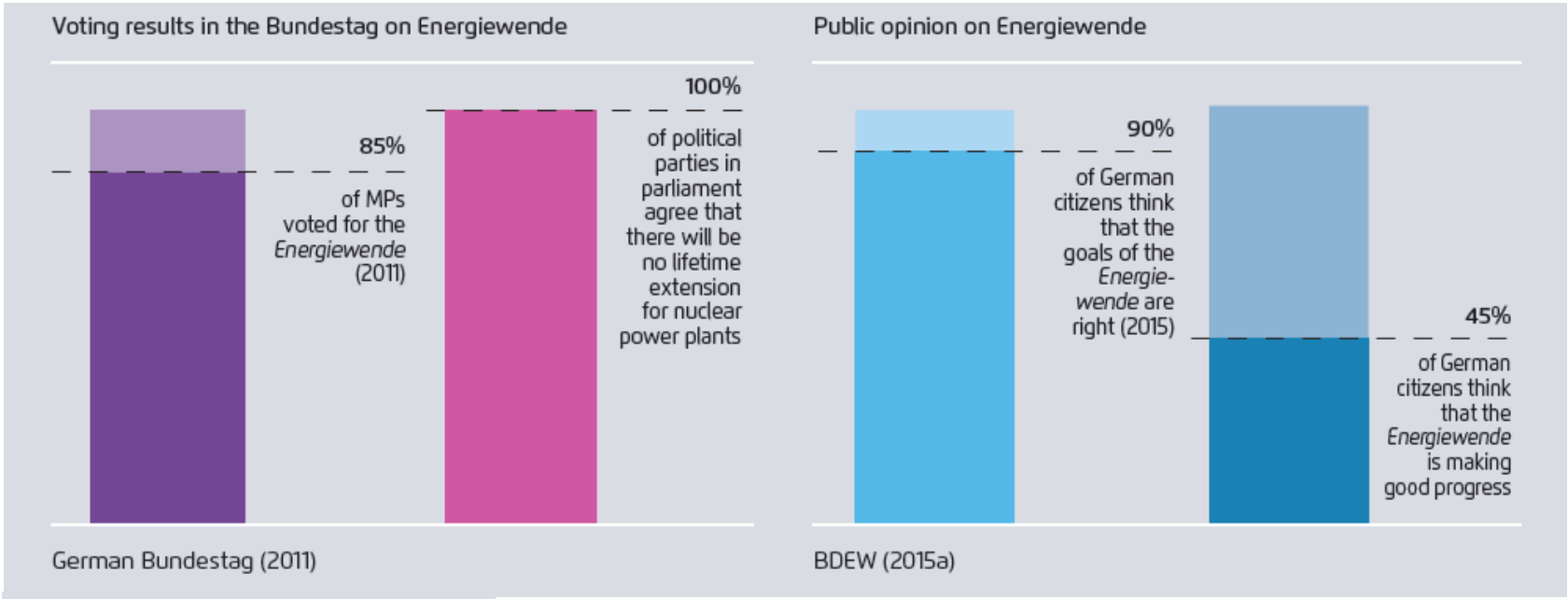
Political an public support of the Energiewende



Source: Understanding the *Energiewende, AGORA 2015, 10*

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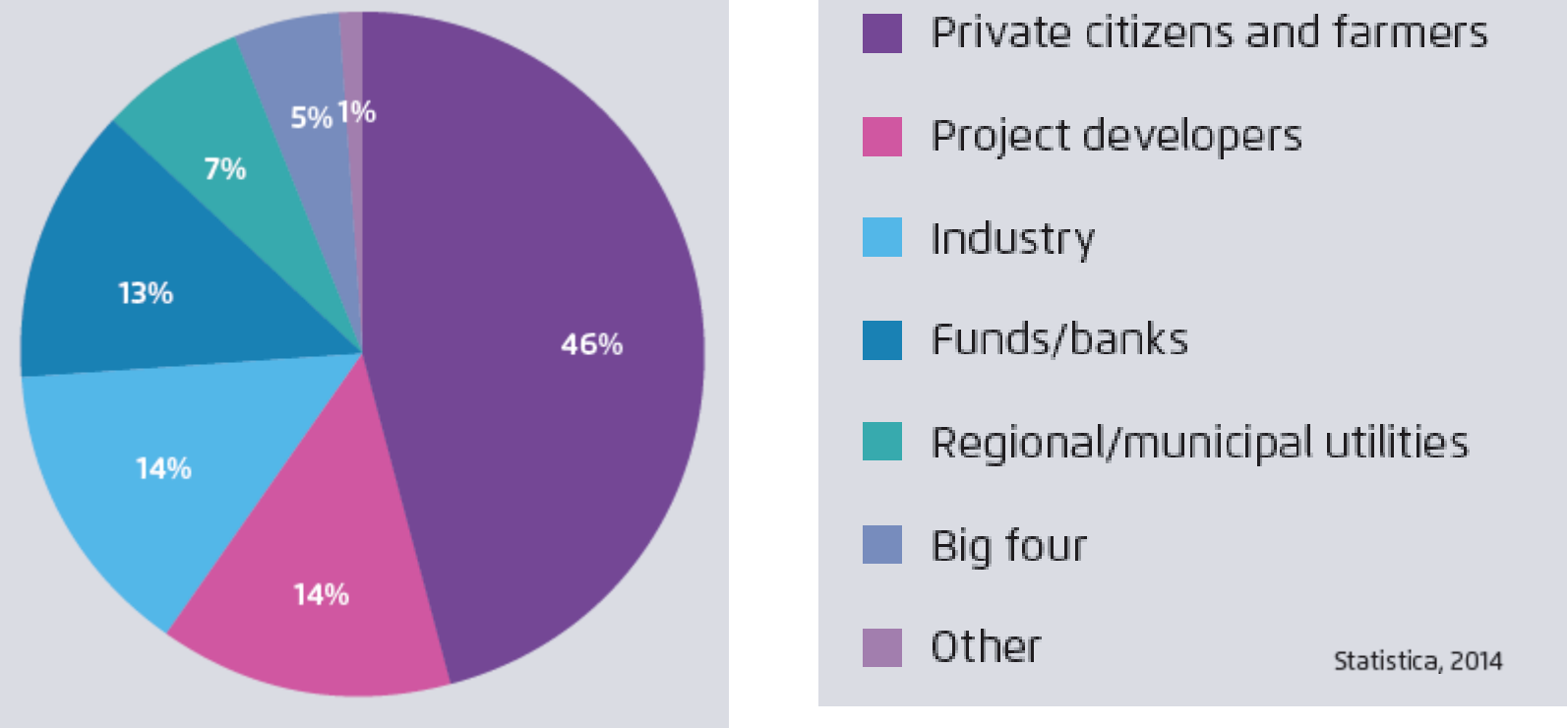
Ownership share of renewable generation in Germany, 2012



Report on the German power system, AGORA 2015, 9

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- **Elements that stabilize the Energiewende:**
  - high Investments in many diversed sectors are bearing the Energiewende; 5% contribution of the utilities;
  - Energiewende is covering all sectors of the economy: electricty production, turbine production, computer sector, heating sector, households, craftsmen 46 % are private citizens and farmers;
  - Energiewende has lost ist green colour and has crossed all political borders;

There are many problems of the nuclear phase-out left to solve but it seems that there will be no way back..